a consequence, it is possible to improve the magnetoresistance variation rate subsequent to film formation in and heat-treatment of the magnetoresistance effect devices, so that magnetoresistance effect devices exhibiting high playback output, low noise levels, high S/N ratios, low error rates, and outstanding device reliability can be obtained, together with magnetoresistance effect sensors, magnetoresistance detection systems, and magnetic storage systems using such devices.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristic thereof. The present embodiments is therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

The entire disclosure of Japanese Patent Application No. 9-123796 (Filed on May 14th, 1997) including specification, claims, drawings and summary are incorporated herein by reference in its entirety.

What is claimed is:

1. A magnetoresistance effect device comprising:

a substrate;

a sublayer directly on and contacting said substrate, said sublayer being one of (1) Ta that is not less than 0.2 nm thick and less than 1.0 nm thick, (2) Hf that is not less than 0.2 nm thick and not more than 1.5 nm thick, and (3) Zr that is not less than 0.2 nm thick and not more than 2.5 nm thick;

an NiFe layer directly on and contacting said sublayer;

a non-magnetic layer directly on and contacting said NiFe layer;

a fixed magnetic layer directly on and contacting said non-magnetic layer; and

an antiferromagnetic layer directly on and contacting said fixed magnetic layer.

2. The magnetoresistance effect device according to claim **1**, wherein said sublayer has a thickness less than 1.0 nm.

3. A magnetoresistance effect device comprising:

a substrate;

a sublayer directly on and contacting said substrate, said sublayer being one of (1) Ta that is not less than 0.2 nm thick and less than 1.0 nm thick, (2) Hf that is not less than 0.2 nm thick and not more than 1.5 nm thick, and (3) Zr that is not less than 0.2 nm thick and not more than 2.5 nm thick;

an NiFe layer directly on and contacting said sublayer;

a CoFe layer directly on and contacting said NiFe layer;

a non-magnetic layer directly on and contacting said CoFe layer;

an MR-enhancing layer directly on and contacting said non-magnetic layer;

a fixed magnetic layer directly on and contacting said MR-enhancing layer; and

an antiferromagnetic layer directly on and contacting said fixed magnetic layer.

4. The magnetoresistance effect device according to claim **3**, wherein said sublayer has a thickness less than 1.0 nm.

5. A shielded magnetoresistance effect sensor comprising:

(a) a lower shield layer laminated on a substrate, the lower shield layer being formed in a prescribed pattern;

(b) a lower gap layer formed on the lower shield layer;

(c) a magnetoresistance effect device laminated on the lower gap layer;

(i) the magnetoresistance effect device comprises:

a sublayer directly on and contacting said lower gap layer, said sublayer being one of (1) Ta that is not less than 0.2 nm thick and less than 1.0 nm thick, (2) Hf that is not less than 0.2 nm thick and not more than 1.5 nm thick, and (3) Zr that is not less than 0.2 nm thick and not more than 2.5 nm thick , an NiFe layer directly on and contacting said sublayer, a non-magnetic layer directly on and contacting said NiFe layer, a fixed magnetic layer directly on and contacting said non-magnetic layer, and an antiferromagnetic layer directly on and contacting said fixed magnetic layer;

(ii) the magnetoresistance effect device is formed in a prescribed pattern;

(d) a vertical bias layer laminated so as to contact the edges of the magnetoresistance effect device;

(e) a lower electrode layer laminated on the vertical bias layer;

(f) an upper gap layer laminated on the lower electrode layer and on the magnetoresistance effect device; and

(g) an upper shield layer laminated on the upper gap layer.

6. The shielded magnetoresistance effect sensor according to claim **5**, wherein said sublayer has a thickness less than 1.0 nm.

7. A shielded magnetoresistance effect sensor comprising:

(a) a lower shield layer laminated on a substrate, the lower shield layer being formed in a prescribed pattern;

(b) a lower gap layer formed on the lower shield layer;

(c) a magnetoresistance effect device laminated on the lower gap layer;

the magnetoresistance effect device comprises:

(i) a sublayer directly on and contacting said lower gap layer, said sublayer being one of (1) Ta that is not less than 0.2 nm thick and less than 1.0 nm thick, (2) Hf that is not less than 0.2 nm thick and not more than 1.5 nm thick, and (3) Zr that is not less than 0.2 nm thick and not more than 2.5 nm thick, an NiFe layer directly on and contacting said sublayer, a CoFe layer directly on and contacting said NiFe layer, a non-magnetic layer directly on and contacting said CoFe layer, an MR-enhancing layer directly on and contacting said non-magnetic layer, a fixed magnetic layer directly on and contacting said MR-enhancing layer, and an antiferromagnetic layer directly on and contacting said fixed magnetic layer; and

(ii) the magnetoresistance effect device is formed in a prescribed pattern;

(d) a vertical bias layer laminated so as to contact the edges of the magnetoresistance effect device;

(e) a lower electrode layer laminated on the vertical bias layer;

(f) an upper gap layer laminated on the lower electrode layer and on the magnetoresistance effect device; and

(g) an upper shield layer laminated on the upper gap layer.

8. The shielded magnetoresistance effect sensor according to claim **7**, wherein said sublayer has a thickness less than 1.0 nm.

9. A magnetoresistance detection system comprising:

(a) a magnetoresistance effect sensor comprising:

(i) a lower shield layer laminated on a substrate, the shield layer formed in a designated pattern;

(ii) a lower gap layer laminated on the lower shield layer;